

A NEW SPECIES OF *CROTALARIA* (FABACEAE) FROM THE FLORIDA CENTRAL RIDGE

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ABSTRACT

Crotalaria avonensis DeLaney & Wunderlin is described from the xeric white sand scrub habitat of Highlands County, Florida. It is compared with *C. rotundifolia*.

INTRODUCTION

Crotalaria is a genus of temperate, subtropical, and tropical plants comprising about 600 species, the majority of which are African. Eleven species have been known hitherto from Florida, but only three of these (*C. pumila* Ortega, *C. purshii* DC., and *C. rotundifolia* (Walt.) Gmelin) are native. Study of the flora of the Lake Wales Ridge in Highlands and Polk counties, Florida, an area well noted for its high endemism, resulted in the discovery of the following unifoliolate *Crotalaria* new to science.

CROTALARIA avonensis DeLaney & Wunderlin, sp. nov. (Figs. 1–5).

A *Crotalaria rotundifolia* (Walt.) J. Gmelin stipulis nullis, vexillo obovato, et stylis paulatim recurvatis differt.

Perennial, erect, virgate or slightly spreading herbs with taproot to 14 mm thick, to 40 cm long, sometimes branching abruptly into 2 to 8 stout, semi-radially disposed secondary roots to 7 mm thick, 14 cm long. Flowering stems 1–3 (-10), 2–10 (-18) cm long arising from the tap root from up to 10 cm below the surface, moderately sericeous, with ascending, loosely appressed, white or yellowish-white trichomes (0.3-) 0.6–1.4 mm long, the longest internodes 8–12 mm long. Stipules absent. Leaves broadly elliptic to orbicular, (5-) 8–19 mm long, (4-) 7–16 mm wide, at base rounded to broadly cuneate, at apex obtuse to emarginate, apiculate, somewhat succulent, both surfaces with white or yellowish-white, loosely appressed trichomes 0.3–1.2 mm long; petioles reddish-brown or green, relatively stout, 1.5–2.8 mm long. Racemes terminal on primary stem

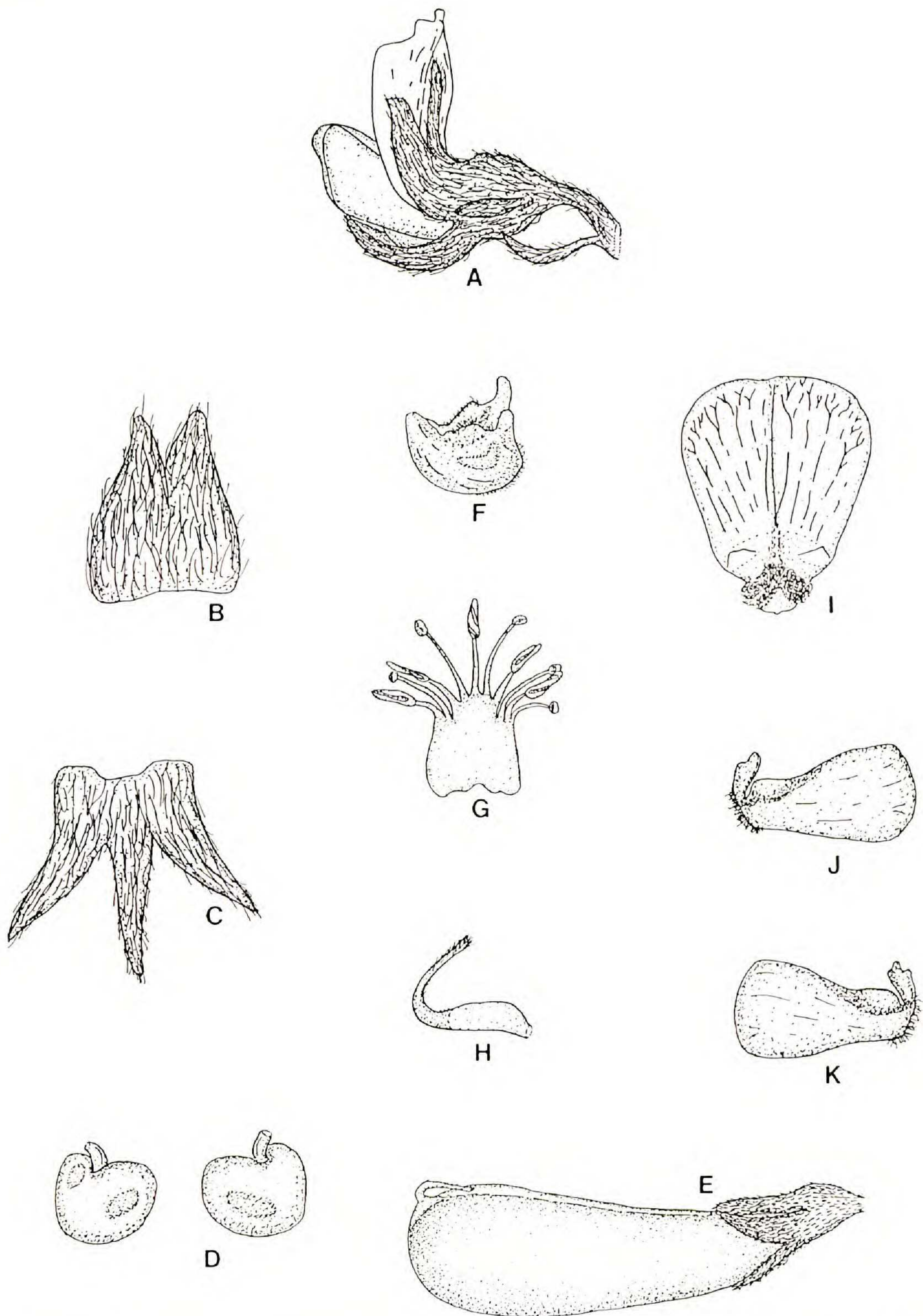


FIG. 1. *Crotalaria avonensis*: a) flower ($4\times$); b) upper calyx lobes ($4\times$); c) lower calyx lobes ($4\times$); d) seeds ($4\times$); e) fruit ($2\times$); f) keel petals ($4\times$); g) androecium ($4\times$); h) gynoecium ($4\times$); i) standard petal ($4\times$); j–k) lateral petals ($4\times$).



FIG. 2. *Crotalaria avonensis*. Habit of flowering plant.

FIG. 3. *Crotalaria avonensis*. Habit of fruiting plant.

and on short leaf-opposed secondary branches; peduncles (1-) 10 – 17 (-33) mm long. Bracts petiolate, linear-elliptic, petiole ca. 0.5 mm long, blade 1.5 – 2.4 (-4.5) mm long, 0.2 – 0.3 (-0.7) mm wide. Pedicels 2 – 3 mm long; buds obliquely conical, angular. Calyces 7 – 8 mm long, tube 2 – 2.5 mm long, with ascending loosely appressed white or yellowish-white trichomes (0.3-) 0.6 – 1.2 mm long; bracteoles linear-elliptic, 1.6 – 2.0 (-2.6) mm long, 0.4 – 0.5 mm wide. Corollas yellow, standard variably brownish-red-lineolate, obovate, 8.0 – 8.7 (-10) mm long, 5.3 – 7.2 mm wide, 1 – 2.5 mm longer than upper calyx lobes, the blade at apex rounded, truncate, sometimes emarginate, each half with a thickened fleshy area near its base, woolly, sometimes ciliate near base; appendages at base of blade triangular, bi-lobed, or absent; wings held above and at a slight angle to the keel, 6.8 – 8.3 (-9.0) mm long, 2.5 – 3.1 (-3.5) mm wide, narrowly obovate, transversely rugose on outer surfaces, usually ciliate at base below; keel ca. 4 mm long, smoothly incurved, beak ca. 1 mm long, with only a slight twist (less than 90°) at tip, slightly protruding into lower median groove of standard, upper and lower free edges slightly ciliate; elongate basifixed anthers ca. 1.2 – 1.4 mm long, short medifixed ones 0.3 – 0.5 mm long; ovaries 1.6 – 2.7 mm long, glabrous or with only a few short trichomes along dorsal suture near base of style, 0.8 – 1.1 mm wide, stipe ca. 1 mm long, style smoothly incurved below the middle, 3 – 3.5 mm long, barbellate on distal abaxial surface and around stigma, sometimes also on basal adaxial surface. Fruits inflated, tan to gray to maroon, glabrous or with only a few short trichomes along distal portion of dorsal suture, 14 – 25 mm long, 5.9 – 7.8 mm wide, stipe 1.5 – 2.0 mm long; seeds chestnut to maroon, up to 18 per pod, 3.4 – 3.8 mm long, ca. 2.4 – 2.6 mm wide.

TYPE: FLORIDA. Highlands Co.: sand pine scrub E of Grassy Pond in the "Big Scrub", ca. 4 mi SE of Avon Park, T33S, R29E, sect. 34, S 1/2, 25 Apr 1988 (fl, fr), *DeLaney 1623* (HOLOTYPE: USF; ISOTYPES: USF; others to be distributed).

PARATYPES: FLORIDA. Highlands Co.: E of Grassy Pond in the "Big Scrub", ca. 4 mi SE of Avon Park, T33S, R29E, Sect. 34, S 1/2, 18 Jun 1986 (st), *DeLaney 1361* (USF); sand pine scrub E of Grassy Pond, ca. 4 mi SE of Avon Park, T33S, R29E, Sect. 34, S 1/2, 20 Mar 1988 (fl), *DeLaney 1621* (USF); Altair Road near Xavier in Avon Park Lakes, 2.5 mi WNW of Avon Park, T33S, 28E, Sect. 7, 20 Mar 1988 (fl), *DeLaney 1622* (USF); W side of Avon park Lakes, ca. 2.5 mi WNW of Avon Park, T33S, R28E, Sect. 7, 12 May 1988 (fl), *DeLaney s.n.* (USF); W side of Avon Park Lakes, ca. 2.5 mi WNW of Avon Park, T33S, R28E, Sect. 7, 8 Apr 1988 (fl, y fr), *Wunderlin & DeLaney 10374* (USF); SE of Grassy Pond, ca. 4 mi SE of Avon Park, T33S, R29E, sect. 34, 8 Apr 1988 (fl, fr), *Wunderlin & DeLaney 10375* (USF); Sebring, 22 Jun 1950, *Garrett s.n.* (FLAS).

The earliest known collection of *Crotalaria avonensis* was made in 1950 by Ray Garrett, an Avon Park botanist. Garrett's specimen was determined as

Crotalaria maritima Chapman (= *C. rotundifolia*) by D. B. Ward in 1967. It was not seen by D. Windler (1974) for his monograph of the North American species. The species was not again collected until 1986 by the senior author. It is notable that Garrett also was the first to collect two other recently described central Florida endemics, *Ziziphus celata* Judd & Hall and *Dicerandra christmanii* Huck & Judd, both of which he recognized as possibly representing new taxa.

Crotalaria avonensis most closely resembles the widespread (Virginia to Florida, west to Louisiana, Mexico to Panama) *C. rotundifolia* (Walt.) Gmelin, one of a complex of 12 species of North American unifoliolate crotalarias (Windler 1974). The resemblance, however, is purely superficial, and the two can readily be separated by a number of characters (Table 1).

Although measurements of the individual floral parts generally are not of use because of the variability of *C. rotundifolia*, the length of the keel in relation to that of the wing petals (shorter in *C. avonensis* and as long or slightly longer in *C. rotundifolia*) is effective in separating the two species.

Crotalaria avonensis is placed in section *Calycinae* Wight and Arn., a section consisting of about 70 species, mostly of tropical Asia but extending to Australia, Africa, and the New World (Polhill 1982). This group includes the North American "Iocaulon" (= subg. *Iocaulon* Raf.) unifoliolates as treated by Windler (1974). This group is apparently of late origin, derived from east Asian progenitors (Polhill 1968). *Crotalaria avonensis* differs from the other native North American unifoliolates by having a curved (vs. geniculate) style (Fig. 5), and a keel with a short beak which is only slightly twisted distally (vs. beak elongated and spirally twisted distally). These characters are present in Old World species of the section but are rare.

Field observations of *Crotalaria avonensis* made over the past two years revealed that the plants are deciduous, typically dying back in the late fall or early winter, and overwintering as a dormant taproot hidden below the soil surface. Flowering begins in mid-March and proceeds into June. This condensed flowering period is characterized by profuse flowering. Some plants are extremely floriferous, producing congested racemes. The earlier flowering shoots are sometimes slender, bearing leaves that are somewhat reduced and widely separated. Single-stemmed plants are frequent, often found flowering at heights 2 to 4 cm. Following the brief flowering period, the plants enter a vegetative phase, often forming compact clusters of stems with crowded ascending leaves that obscure the internodes, giving a bushy, rosette-like appearance. Only an occasional flower appears during this phase of growth.

Crotalaria avonensis is restricted to two areas of sparsely vegetated, xeric,



FIG. 4. *Crotalaria avonensis*. Flower.



FIG. 5. *Crotalaria avonensis* (top) and *C. rotundifolia* (bottom). Gynoecia (darkfield, 50% transmitted light).

TABLE 1. Comparison of *Crotalaria avonensis* and *C. rotundifolia*.

CHARACTER	C. AVONENSIS	C. ROTUNDIFOLIA
Standard petal shape	obovate	orbicular
Style base shape	smoothly recurved	geniculate
Length of style	3–3.5 mm	4–6.9 mm
Style vesture	barbellate primarily on abaxial surface	barbellate primarily on adaxial surface
Stipules	absent	present
Keel to wing petal length	shorter than wing petals	equalling or slightly longer than wing petals
Wing petal position	distal ends held above keel	distal ends enveloping keel
Blade of lateral petals	pubescent on lower surface	glabrous on lower surface
Claw of lateral petals	evidently ciliate on lower edge	eciliate or sparsely ciliate on lower edge
Habitat	white sand scrub (Archbold and Satellite soils)	sandhill, pine flatwoods, disturbed areas (various soils)
Habit	ascending	procumbent, decumbent, or ascending
Flowering period	March-June	throughout the growing season throughout most of the year
Keel beak	short; only slightly twisted distally; curved back to standard	elongate; spirally twisted distally; projected upward and outward
Mature fruit color	tan to gray to maroon	black

white sand scrub that exhibit an exceedingly high diversity and density of endemic species. All populations occur on well drained Archbold, or somewhat poorly drained Satellite, deep white sands, which contain extremely low clay and organic components. As with many other endemic species of the Lake Wales Ridge, plants of *C. avonensis* tend to occur more frequently along the man-disturbed white sand edges, where competition is much reduced. Although the majority grow in full sun, many occur in partial shade in and among other plants, particularly such Florida endemics as *Bonamia grandiflora*, *Calamintha ashei*, *Conradina canescens*, *Liatris oblingerae*, *Paronychia chartacea*, *Polygonella basiramia*, *Polygonella myriophylla*, but also many other shrubby and herbaceous scrub plants. Plants often occur in association with, and emerge through and between, clumps of ground lichens: *Cladonia evansii* Abb., *C. leporina* Fr., and *C. subtenuis* (Abb.) Evans.

Crotalaria avonensis is known from only two localities on the Lake Wales Ridge, about 10 miles apart, in Highlands County. The Lake Wales Ridge is a narrow elevated area a few miles wide and about a hundred miles long, extending from southeastern Lake County to southern Highlands County. Its characteristic vegetation is xeric scrub dominated by sand pine (*Pinus clausa*) and various oak species (*Quercus*). The ridge scrub, especially the southern portion, is rich in endemics. A number of the species are of very limited distribution. For example *Dicerandra christmanii* Huck & Judd, *Dicerandra frutescens* Shinnery, *Eryngium cuneifolium* Small, *Hypericum cumulicola*, *Liatris oblingerae*, *Paronychia chartacea*, *Polygonella basiramia*, and *Ziziphus celata* Judd & Hall are limited to Highlands and/or Polk counties. About 33% of the species associated with *Crotalaria avonensis* are endemic or nearly endemic to the state (Table 2). Since the very narrow endemics *Dicerandra christmanii*, *Ziziphus celata*, and *Crotalaria avonensis* were all discovered during the last five years, further field work by experienced botanists in the scrub in Polk and Highlands counties is clearly needed.

Crotalaria avonensis appears well adapted to its xeric habitat by a deep, buried taproot, early and short blooming period, and compact growth habit. Its distinctive floral morphology suggests that it diverged very early, assuming that its progenitor was a *C. rotundifolia*-like species. It thus appears to be another Miocene relic species endemic to the southern Lake Wales Ridge.

The species is in imminent danger of extirpation. The type locality is contained within the now defunct Sebring Highlands development which is subdivided into ca. 1.25 acre tracts. The other population is confined to the east side of Avon Park Lakes development, which is subdivided into ca. 0.25 acre tracts. Local use of the Avon Park Lakes site for off-road vehicles has already damaged parts of the population. Encroaching citrus farming, sod farming, and off-road vehicles threaten the Grassy Pond population. The natural plant communities of the Lake Wales region are rapidly being destroyed by expansion of the citrus industry and by urban development. It is estimated that less than 10% of the original Lake Wales scrub vegetation remains and that less than 3% of the total land of the region is protected from development. It therefore is increasingly urgent that intensive botanical studies are conducted in the Lake Wales region.

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TABLE 2. Taxa associated with *Crotalaria avonensis*. Voucher specimens deposited at USF. Taxa endemic or nearly endemic to Florida are indicated with an asterisk (*).

<i>Aristida gyrans</i> Chapm.	<i>Palafoxia feayi</i> A. Gray *
<i>Asclepias curtissii</i> A. Gray *	<i>Paronychia americana</i> (Nutt.) Fenzl ex Walp.
<i>Asclepias tuberosa</i> subsp. <i>rolfsii</i> (Britt.) Woods	<i>Paronychia chartacea</i> Fern. *
<i>Asimina obovata</i> (Willd.) Nash *	<i>Paronychia herniarioides</i> (Michx.) Nutt.
<i>Asimina reticulata</i> Chapm. *	<i>Persea humilus</i> Nash *
<i>Balduina angustifolia</i> (Pursh) Robins.	<i>Physalis walteri</i> Nutt.
<i>Befaria racemosa</i> Vent.	<i>Pinus clausa</i> (Chapm. ex Engelm.)
<i>Bonamia grandiflora</i> (A. Gray) Heller *	Vasey ex Sarg. *
<i>Bulbostylis ciliatifolia</i> (Ell.) Fern.	<i>Piptochaetium avenaceum</i> (L.) Parodi
<i>Bulbostylis warei</i> (Torr.) Clarke	<i>Pityopsis graminifolia</i> (Michx.) Nutt.
<i>Bumelia tenax</i> (L.) Willd.	<i>Polanisia tenuifolia</i> Torr. & Gray
<i>Calamintha ashei</i> (Weatherby) Shinnery *	<i>Polygonella basiramia</i> (Small) Nesom & Bates *
<i>Ceratiola ericoides</i> Michx.	<i>Polygonella gracilis</i> (Nutt.) Meisn.
<i>Chamaecrista fasciculata</i> (Michx.) Greene	<i>Polygonella myriophylla</i> (Small) Horton *
<i>Chapmannia floridana</i> Torr. & Gray *	<i>Polygonella polygama</i> (Vent.) Engelm. & Gray
<i>Chionanthus pygmaeus</i> Small *	<i>Polygonella robusta</i> (Small) Nesom & Bates *
<i>Clitoria fragrans</i> Small *	<i>Polypremum procumbens</i> L.
<i>Cnidoscolus stimulosus</i> (Michx.) Engelm. & Gray	<i>Prunus geniculata</i> Harper *
<i>Commelina erecta</i> L.	<i>Pterocaulon pycnostachyum</i> (Michx.) Elliott
<i>Conradina canescens</i> (Torr. & Gray) A. Gray	<i>Quercus chapmanii</i> Sarg.
<i>Cuthbertia ornata</i> Small *	<i>Quercus geminata</i> Small
<i>Cyperus retrorsus</i> Chapm.	<i>Quercus inopina</i> Ashe *
<i>Dalea feayi</i> (Chapm.) Barneby	<i>Quercus myrtifolia</i> Willd.
<i>Eriogonum longifolium</i> var. <i>gnaphalifolium</i> Gandg. *	<i>Rhynchelytrum repens</i> (Willd.) C. E. Hubb.
<i>Erythrina herbacea</i> L.	<i>Rhynchosia cinerea</i> Nash *
<i>Euphorbia inundata</i> Torr. ex Chapm.	<i>Rhynchospora megalocarpa</i> A. Gray
<i>Galactia elliottii</i> Nutt.	<i>Sabal etonia</i> Swingle ex Nash *
<i>Galactia regularis</i> (L.) BSP.	<i>Schizachyrium niveum</i> (Swallen) Gould *
<i>Galactia volubilis</i> (L.) Britt.	<i>Schrankia microphylla</i> var. <i>floridana</i>
<i>Garberia heterophylla</i> (Bartr.) Merr. & Harp. *	(Chapm.) Isely
<i>Gnaphalium falcatum</i> Lam.	<i>Selaginella arenicola</i> Underw.
<i>Helianthemum nashii</i> Britt. *	<i>Serenoa repens</i> (Bartr.) Small
<i>Hypericum cumulicola</i> (Small) P. Adams *	<i>Seymeria pectinata</i> Pursh
<i>Hypericum reductum</i> P. Adams	<i>Sisyrinchium xerophyllum</i> E. Greene *
<i>Ilex ambigua</i> (Michx.) Torr.	<i>Smilax auriculata</i> Walt.
<i>Ilex glabra</i> (L.) A. Gray	<i>Solidago odora</i> var. <i>chapmanii</i> (A. Gray) Cronq.
<i>Ilex opaca</i> var. <i>arenicola</i> (Ashe) Ashe *	<i>Stillingia sylvatica</i> L.
<i>Indigofera caroliniana</i> Mill.	<i>Stipulicida setacea</i> Michx.
<i>Lechea deckertii</i> Small	<i>Stylisma abdita</i> Myint *
<i>Lechea minor</i> L.	<i>Tephrosia spicata</i> (Walt.) Torr. & Gray
<i>Liatris oblingerae</i> (Blake) Robins. *	<i>Tillandsia recurvata</i> (L.) L.
<i>Licania michauxii</i> Prance	<i>Tradescantia roseolens</i> Small*
<i>Linaria floridana</i> Chapm.	<i>Tragia urens</i> L.
<i>Lupinus diffusus</i> Nutt.	<i>Trichostema dichotomum</i> L.
<i>Lyonia fruitcosa</i> (Michx.) Torr.	<i>Vaccinium darrowii</i> Camp.
<i>Lyonia lucida</i> (Lam.) D. Don	<i>Vaccinium myrsinites</i> Lam.
<i>Matalea pubiflora</i> (Decne.) Woods.	<i>Vitis aestivalis</i> Michx.
<i>Nolina brittoniana</i> Nash *	<i>Vitis munsoniana</i> Simpson
<i>Opuntia humifusa</i> (Raf.) Raf.	<i>Ximena americana</i> L.
<i>Osmanthus megacarpus</i> Small *	<i>Yucca filamentosa</i> L.

of the color plate, and the curator of the Herbarium of the Florida Museum of Natural History for loan of the Garrett specimen.

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